Conversion of Petroleum Contaminated Soil into Asphalt-Treated Road Base

U.S. Army Corps of Engineers, Alaska District

Conversion of Petroleum Contaminated Soil into Asphalt-Treated Road Base

- Location: Kodiak Island, Alaska
- Program: Formerly Used Defense Sites (FUDS)
- Prime Contractor: Jacobs Engineering

Asphalt Disposal Area Prior to Cleanup

Asphalt Disposal Area During Cleanup

Drums from Asphalt Disposal Area

Asphalt Disposal Area After Cleanup

Storage and Processing Site

Material Characteristics

- Contaminants:
- Diesel Range Organics concentrations ranged from 171 – 52,000ppm. The cleanup level was 230ppm.
- Residual Range Organics concentrations ranged from 140 – 42,000ppm. The cleanup level was 8,300ppm.

Material Characteristics, Continued

- Gradation:
- Some of the material exceed 1 inch in size. In 2001, crushing was utilized to reduce the size of this fraction to minus 1-inch.

Crusher Utilized During 2001

Description of the Foamed Asphalt Process

- Asphalt cement is heated
- A small amount of water is injected into the heated asphalt cement, this greatly expands the volume, forming a foam. Foam formation causes a reduction in the viscosity of the asphalt cement, making it easier for it to flow.

Description of the Foamed Asphalt Process, continued

- The foamed asphalt is immediately mixed with cold, damp aggregate. This asphalt coating binds up the fines fraction.
- Foamed asphalt remains workable for an extended period and is not as dependent upon climatic conditions as asphalt emulsions are.

Foamed Asphalt Plant and Bitumen Tanker -

Asphalt-Treated Base Out of the Plant

Loading Trucks w/Asphalt-Treated Base Material

The Kodiak Island Highway

Unloading Asphalt-Treated Base Material

Contouring Asphalt-Treated Base

Contouring Asphalt-Treated Base

Roughed in Asphalt-Treated Base

Compacting Asphalt Treated Base

Compaction of Asphalt Treated Base

- Asphalt-treated base was placed in two lifts. Each lift was 4-inches thick, minimum.
- Initial compaction was achieved with a 14-ton double-steel drum vibratory compactor.
- Finish compaction was achieved with a pneumatic rubber-tired finish roller.
- Compaction was achieved to within 98% of a field-determined maximum compaction, 139.3 lb./cu. ft.

Pavement (Topcoat) Application

Paving

Compacting Pavement

Standards for the Road Base

- ENVIRONMENTAL – CONTAMINANT CHARACTERISTICS
- Tested via Synthetic Characteristic Leaching Procedure (SPLP) for Diesel Range Organics, Residual Range Organics and BTEX.
- SPLP leachate was compared to drinking water standards (18 AAC 75.345, Table C)
- Leachate largely met requirements of Table C.

Standards for the Road Base continued

- ENVIRONMENTAL – PLACEMENT
- Corrective Action criteria under 18 AAC 78.250(e)(12)(G) were considered. This specifies placement requirements when disposing of hydrocarbon-contaminated soil as a base for a physical barrier, in this case, the pavement cap.
- Maximum layer thickness of 18 inches (vi)
- Placement may be no closer than 18 inches from the edge of the impervious pavement (viii)
- Placement can be no closer than 6 vertical feet from the seasonal high groundwater table.
- Placement can be no closer than 100 feet from surface waters (18 AAC 78.274(2)(A)).

Standards for the Road Base continued

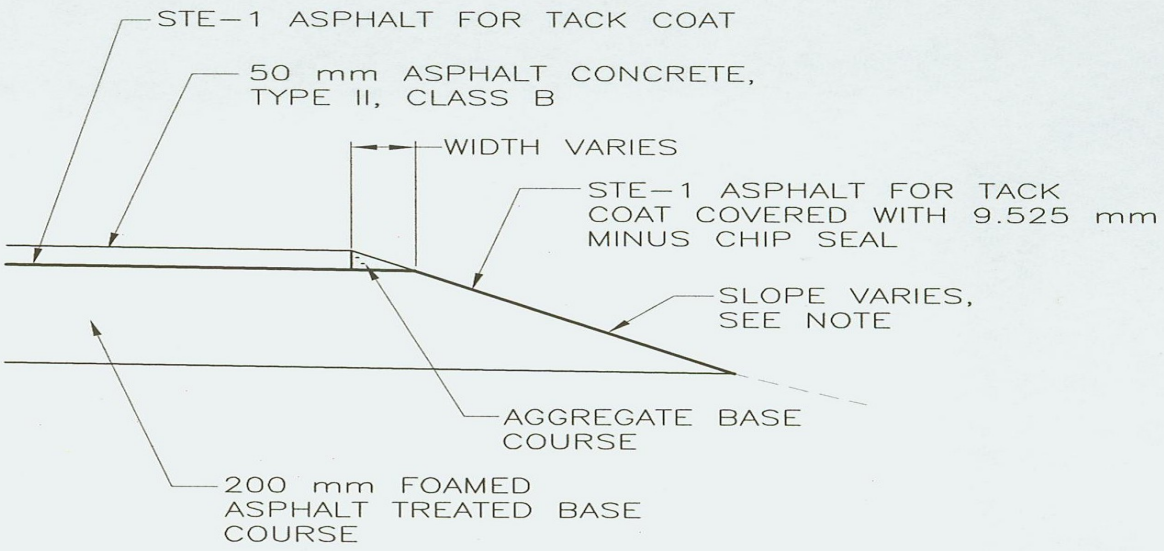
- ENVIRONMENTAL STANDARDS WAIVERS
- Contaminant leachate largely meeting Table C, coupled with the location and nature of the rural roadway led to a waiver of the requirement that asphalt-treated base be placed no closer than 18 inches from the edge of the pavement. This allowed the construction of a structurally consistent roadway without longitudinal seams. Such seams could have led to future problems in the road structure.
- The fact that asphaltic highway products are not normally subjected to scrutiny under leachate tests, and that results largely passed drinking water standards, and the conservative nature of comparison to drinking water standards, allowed some sample exceedances.

Standards for the Road Base continued

- GEOTECHNICAL STANDARDS
- There were two major issues: Gradation and moisture content.
- Alaska Department of Transportation and Public Facilities (ADOT/PF) standards for D-1 aggregate require 100 percent passing a 1-inch sieve, and less than six percent passing a No. 200 (fines) sieve.
- Crushing was utilized to ensure that all aggregates passed a 1-inch sieve.
- The addition of quicklime and asphalt to the aggregates bound up the fines, preventing them from passing a No. 200 sieve.

Standards for the Road Base continued

- GEOTECHNICAL STANDARDS
- The foamed asphalt mix design study found that a moisture content of 10% or less was needed. Stockpiles of aggregate contained anywhere from 7-17% moisture.
- Moisture content issue was solved by: mixing wetter aggregates with drier ones, turning aggregates to allow some air-drying and the addition of quicklime.
- Benefits of quicklime were threefold: some moisture in the aggregates converted quicklime to hydrated lime, an exothermic reaction. The heat of this reaction drove away additional water enough to make some stockpiles steamy. The addition of quicklime also diluted the moist aggregates with dry material.


STE–1 ASPHALT FOR TACK COAT
50 mm ASPHALT CONCRETE, TYPE II, CLASS B
WIDTH VARIES
STE–1 ASPHALT FOR TACK COAT COVERED WITH 9.525 mm MINUS CHIP SEAL
SLOPE VARIES, SEE NOTE
AGGREGATE BASE COURSE
200 mm FOAMED ASPHALT TREATED BASE COURSE

NOTE: VARY SLOPE TO MATCH RECONDITIONED ROAD BED AS DIRECTED BY THE SITE MANAGER, MAX SLOPE 2:1. CONSTRUCT MAXIMUM 3:1 SLOPE IN AREAS THAT PROVIDE SUFFICIENT ROAD WIDTH.

ASPHALT PAVING PROJECT
REVISED SHOULDER BACKING DETAIL

KODIAK ISLAND, ALASKA

PROJECT MANAGER: T. Beck	FILE NAME: Section Revision.dwg	DATE: Aug. 4, 03
JE DRAWN BY: BJP	LAYOUT TAB: Section Revision	FIGURE NO.: 1
	FILE LOCATION: Kodiak \ 05M30506 \ Road Design	

Compacting Shoulders

Chip Coating the Shoulder

Finished Road

Project Scope and Cost

- A total of 34,358 tons of asphalt-treated road base were produced and placed.
- 3.75 miles of roadway were paved.
- The estimated cost of disposal by thermal treatment is $140/ton.
- Costs for this project were $121/ton, yielding a cost savings of $700,000.

Project Scope and Cost continued

- The $700,000 savings does not consider the benefit to the State of Alaska in having 3.75 miles of roadway paved at no cost. ADOT/PF had planned to pave this road in the near future.
- The cost of purchasing aggregates provided by this project on Kodiak Island would have exceeded $200,000.

Earthquake Fracture

QUESTIONS?